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Operation, Maintenance, and Monitoring Report for the Soil Gas Interim Remedial Measure

2012 Annual Summary

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York

NYSDEC ID # 1-30-003A

ARCADIS

Paul Martorano, PE
Staff Engineer

Kenneth Zegel, PE
Senior Engineer

Carlo San Giovanni
Project Manager

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Prepared for:
Northrop Grumman Systems Corporation

Prepared by:
ARCADIS of New York, Inc.
Two Huntington Quadrangle
Suite 1S10
Melville
New York 11747
Tel 631 249 7600
Fax 631 249 7610

Our Ref.:
NY001496.1212.SGSI4

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1. Introduction

Pursuant to the Administrative Order on Consent (AOC) Index # W1-0018-04-01 (NYSDEC 2005), ARCADIS of New York, Inc. (ARCADIS), on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), has prepared this Operable Unit 3 (OU3) Soil Gas Interim Remedial Measure (soil gas IRM) Operation, Maintenance, and Monitoring (OM&M) 2012 Annual Summary Report for submittal to the New York State Department of Environmental Conservation (NYSDEC). The present day Bethpage Community Park property (Park) and the Former Grumman Plant 24 Access Road, which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, are referred to herein as the "Site Area". A Site Area location map is provided on Figure 1.

The soil gas IRM has been operational since February 18, 2008. This OM&M report summarizes the soil gas IRM activities conducted, data collected, system alarms, conclusions, recommendations, and engineering certification for the soil gas IRM during 2012 (i.e. from January 2012 through December 2012). Additionally, this report summarizes the OM&M activities performed during the 4th Quarter of 2012 (i.e. October 1 through December 31, 2012 [the reporting period]). Detailed OM&M summaries for the previous three 2012 operational quarterly periods are available in the following reports (2012 Quarterly Reports):

- Quarterly OM&M Report for the Soil Gas IRM, March 2012 (ARCADIS 2012a)
- Quarterly OM&M Report for the Soil Gas IRM, June 2012 (ARCADIS 2012b)
- Quarterly OM&M Report for the Soil Gas IRM, September 2012 (ARCADIS 2012c)

During 2012, the soil gas IRM system OM&M was conducted in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009) and the NYSDEC-approved Sampling and Analysis Plan (SAP) (ARCADIS 2008).

As discussed in the OU3 Site Area Remedial Investigation Report (Site Area RI) (ARCADIS 2011a), Northrop Grumman does not take responsibility for certain compounds (e.g., Freon 12 and Freon 22) present in the Site Area. Throughout this report, a distinction is made between the "Project" and "Non-project" volatile organic compounds (VOCs), which are defined as follows:

- "Project VOCs": VOCs that may be related to former Grumman historical activities. For this report, Project VOCs include 1,1,1-Trichloroethane; 1,1-Dichloroethane; 1,2- Dichloroethane; 1,1-Dichloroethene; Tetrachloroethene; Trichloroethene; Vinyl Chloride; cis-1,2-Dichloroethene; trans-1,2-Dichloroethene; Benzene; Toluene; and Total Xylenes.

- "Non-project VOCs": VOCs, such as Freon 12 and Freon 22 that are understood to be unrelated to former Grumman activities but have been detected in the Site Area. As noted in the Site Area RI (ARCADIS 2011a), a sub-plume of Freon 22 has been identified originating from the area of the Town of Oyster Bay's (Town's) former ice rink. Based on Town information (Zervos, Theodore 2007), Freon 22 was used by the Town and released to the environment.

2. Soil Gas Interim Remedial Measure System Description and Objectives

The soil gas IRM was constructed in accordance with the NYSDEC-approved (NYSDEC 2007) Soil Gas IRM 95% Design Report and Design Drawings (ARCADIS 2007). A general site plan is provided on Figure 2 that shows the treatment building (which houses the major process equipment, including two 20-horsepower [hp] and one 30-hp regenerative-type depressurization blowers, three 52-gallon moisture separators and associated transfer pumps, one heat exchanger, and one 33-foot tall by 16-inch diameter stack), the 18 depressurization wells, and the 47 induced vacuum monitoring wells. Monitoring well vacuum measurements are also provided on Figure 2. A process flow diagram that shows sampling and monitoring locations is provided on Figure 3. A detailed description of the system and a complete set of record drawings are provided in the OM&M Manual (ARCADIS 2009).

The remedial action objectives of the soil gas IRM are as follows:

- To mitigate the off-site migration of project VOCs in the on-site soil gas through the implementation of a soil gas control system installed along the former Plant 24 access roads south and west of the Park.

- To comply with applicable NYSDEC Standards, Criteria and Guidelines (SCGs).

The performance objectives of the soil gas IRM are as follows:

- To mitigate the offsite migration of soil gas, the system was designed to maintain -0.1 inches of water column (iwc) of vacuum within a negative pressure curtain

established along the former Plant 24 southern and western access roads, based on a twelve-month rolling average.

- To, initially, collect and treat vapors until it is demonstrated that all VOCs in the influent (untreated) vapor stream are less than the NYSDEC Division of Air Resources Guide-1 (DAR-1) Annual Guidance Concentrations (AGCs) on a twelve-month rolling average and Short-Term Guidance Concentrations (SGCs) for any given grab sample (NYSDEC 2010). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).

- To collect and transfer collected condensate to the Nassau County Department of Public Works (NCDPW) intake located on Northrop Grumman property, in accordance with the requirements set forth by the NCDPW (NCDPW 2007; NCDPW 2008). The sanitary sewer intake ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility.

3. Operation and Maintenance Activities

3.1 Fourth Quarter 2012

In general, the soil gas IRM operated continuously during the reporting period. Routine monthly operation and maintenance (O&M) activities included: inspection of all piping, appurtenances, and mechanical equipment for leaks, defects, or other problems; maintenance of equipment in accordance with the manufacturers' specifications; and adjustment of valves and equipment set points to maintain treatment system operating ranges for flow and vacuum.

The following non-routine system maintenance activities or system shutdowns occurred during the reporting period:

- The system was shut down for approximately four (4) days, between October 29 and November 2, 2012, due to Hurricane Sandy. The system was inspected for damage and restarted on November 2, 2012. During the inspection, damage to the effluent stack, attributed to Hurricane Sandy, was noted. Follow-up detailed inspections of the stack did not identify any leaks or holes. Additional measures to brace and stabilize the stack to prevent future damage are being considered.

- The system shut down for approximately three (3) days between November 21 and 24, 2012 as a result of a knockout tank high-high-level alarm condition

(LAHH-400). The knock-out tank was drained and the system was inspected and restarted on November 24, 2012.

- The system shut down for approximately one (1) day on November 25, 2012, due to a blower (i.e., BL-400) motor fault alarm condition. Operations staff noted that the OU-3 Groundwater IRM system had shut down at approximately the same time, leading to the conclusion that the shutdown was power related. The system was inspected and restarted on November 26, 2012.

- Troubleshooting activities recommended in the Quarterly OM&M Report for the Soil Gas IRM, September 2012 (ARCADIS 2012c) were completed on December 19, 2012 to assess the cause of the measured low induced vacuum at compliance monitoring wells VMWC-7A and VMWC-18A. It was determined that condensate accumulation in the Depressurization Well DW-2S and DW-11S subsurface pipelines is preventing the induced vacuum at compliance monitoring wells VMWC- 7A, VMWC- 7B, VMWC-18A and VMWC-18B from reaching their design values of -0.1 iwc. A subsurface depressurization well pipeline condensate removal event has been scheduled for the next reporting period to address this issue.

3.2 2012 Annual System Performance and Alarm Summary

In general, except as described below, the soil gas IRM operated continuously during 2012, with scheduled system shut downs for routine maintenance activities. Routine monthly O&M activities conducted throughout 2012 included inspection of all piping, appurtenances, and mechanical equipment for leaks, defects, or other problems and maintenance of equipment, in accordance with the manufacturers' specifications and as described in the OM&M Manual (ARCADIS 2009).

The 2012 system operation up-time and system shut downs that occurred in 2012 are summarized below and are described in the 2012 Quarterly OM&M Reports (ARCADIS 2012a, ARCADIS 2012b, and ARCADIS 2012c):

- The system operated full-time 356 out of 366 days (97 percent uptime).

- There were 10 days of system downtime, consisting of:

    - Two (2) days due to temporary power interruptions;

    - Four (4) days due to shut down during Hurricane Sandy;

- One (1) day due to system maintenance associated with condensate removal from the subsurface piping; and

- Three (3) days due to a high water level alarm (LAHH-400) in the moisture knock-out drum associated with B-400.

4. Monitoring Activities and Results

The following subsections of this report summarize the monitoring activities and results of routine performance and compliance monitoring for the reporting period. An annual summary of the routine performance and compliance monitoring activities performed during 2012 is also provided in Section 4.2.

The objectives of the performance monitoring program are to demonstrate that the system components are operating in accordance with the manufacturer's specifications and that the operating parameters are within acceptable operating ranges, as provided in revised Table 3 from the OM&M Manual (ARCADIS 2011b). The purpose of the compliance monitoring program (consisting of the collection of compliance-related induced vacuum readings and effluent vapor/water samples) is to demonstrate compliance with the performance objectives described in Section 2.

4.1 Fourth Quarter 2012 Monitoring Activities and Results

4.1.1 Routine Performance Monitoring

The routine quarterly performance monitoring event was completed on December 20, 2012 (hereinafter referred to as the "December monitoring event"). A brief discussion of the monitoring results obtained is provided below.

4.1.1.1 System Operating Parameters

System operating parameters measured during the December monitoring event are summarized in Tables 1 and 2. Except as summarized below, system operating parameters were consistent with the recommended values in revised Table 3 of the OM&M Manual (ARCADIS 2011b). During the reporting period, system components were operated in accordance with manufacturers' recommendations. The heat exchanger influent temperature remained lower than the design influent temperature (i.e., 150 degrees Fahrenheit); accordingly, the heat exchanger was kept on stand-by.

System operating parameters measured during the December monitoring event that were not consistent with the recommended values in revised Table 3 of the OM&M Manual (ARCADIS 2011b) are as follows:

- Depressurization Wells DW-5D, DW-7D, DW-10S, and DW-11S had manifold flow rates lower than the minimum recommended ranges.
- Depressurization Wells DW-2S and DW-9S had manifold flow rates higher than the maximum recommended ranges.
- Depressurization Wells DW-2S, DW-5S, DW-7S, and DW-10S had manifold vacuums higher than the maximum recommended range.
- Depressurization Wells DW-1S, DW-2S, and DW-7S had wellhead vacuums slightly higher than the maximum recommended range.
- Depressurization Wells DW-10S and DW-11S had wellhead vacuums lower than the minimum recommended range.
- Compliance related monitoring points VMWC-7A/B and VMWC-18A/B had induced vacuums lower than the minimum recommended ranges.
- Compliance related monitoring points VMWC-14B/D had induced vacuums slightly higher than the maximum recommended ranges.
- Blower B-400 had an influent vacuum slightly higher than the maximum recommended range.

Based on troubleshooting activities conducted on December 19, 2012, the observed changes in flow rate, manifold vacuum, induced vacuum, and blower influent vacuum are likely the result of condensate and/or storm water accumulation in the subsurface piping. As previously described, a pipeline condensate removal event has been scheduled for the next reporting period.

4.1.1.2 Vapor Sample

The total effluent screening level vapor sample photoionization detector (PID) reading measured during the reporting period is provided in Table 1. The screening result was

0.5 parts per million by volume, which is consistent with September 2012 and other historical data.

4.1.2 Routine Compliance Monitoring

Routine compliance monitoring was conducted during the December monitoring event. A brief discussion of the compliance monitoring results is provided below.

4.1.2.1 System Operating Parameters

Instantaneous vacuum measurements in compliance monitoring wells from the December monitoring event and annual time-weighted rolling averages are summarized in Table 2. December measurements are also shown (in text box format) on Figure 2. The soil gas IRM design objectives are provided in Section 2.

As shown on Table 2, during the December monitoring event the induced vacuum at all compliance related monitoring points was greater than or equal to -0.1 iwc, with the exception of VMWC-7A/B and VMWC-18A/B. The annual time-weighted rolling average induced vacuum at all compliance related monitoring points to date is greater than or equal to -0.1 iwc (the December monitoring event average induced vacuum was -0.15 iwc) with the exception of VMWC-18A, which had an annual time-weighted rolling average induced vacuum of -0.08 iwc. The observed decrease in the induced vacuum measured at VMWC-7A/B and VMWC-18A/B and the annual time-weighted rolling average induced vacuum measured at VMWC-18A was determined to be the result of condensate and/or storm water accumulation in the subsurface piping of DW-2S and DW-11S. It should be noted that a constant vacuum was maintained at all compliance monitoring points during the reporting period, and the annual time-weighted rolling average induced vacuum was sufficient to prevent soil gas from migrating off-site, as typical industry guidance recommends a vacuum of -0.035 iwc for the control of soil vapor (USEPA 1993). As stated previously, a condensate removal event is scheduled for the next reporting period. The system will be rebalanced immediately after the condensate removal event to return the induced vacuum at VMWC-7A/B and VMWC-18A/B to above -0.1 iwc.

4.1.2.2 Vapor Sample

A total effluent vapor sample was collected on December 20, 2012. As shown in the laboratory results in Table 3 and Appendix A-1, the total volatile organic compound (TVOC) concentration of 1,323 micrograms per cubic meter ($\mu g/m^3$) was consistent

with the September 2012 concentration (1,601 µg/m^3). The Project TVOC concentration of 1,053 µg/m^3 and the Non-project TVOC concentration of 270 µg/m^3 were also consistent with the September 2012 concentrations (1,127 µg/m^3 and 474 µg/m^3, respectively) and other historical data.

Benzene and vinyl chloride were the two environmentally "A" rated compounds (as defined in Division of Air Resources [DAR-1] Annual Guideline Concentration [AGC]/Short-Term Guideline Concentration [SGC] tables revised October 18, 2010) detected in the effluent vapor sample during December 2012.

Several tentatively identified compounds (TICs) were also identified by the laboratory (Appendix A-2). The TICs identified were present at the same magnitude compared to the September 2012 sample results.

Air emissions modeling, completed to confirm compliance with applicable air discharge standards, is discussed in Section 5 of this report.

4.1.3 Condensate Samples

A compliance monitoring condensate sample was not collected for laboratory analysis during the reporting period. Nonetheless, a table that indicates no samples were collected during the reporting period is provided as Table 4. A similar appendix table has been provided in Appendix B.

4.2 2012 Annual Summary of Monitoring Activities and Results

4.2.1 2012 Annual Summary of Routine Performance Monitoring

Discussion of the routine quarterly performance monitoring events performed during 2012 is provided below.

4.2.1.1 System Operating Parameters

Similar to the reporting period, system performance monitoring completed in 2012 consisted of the collection of system operating parameters and system performance vapor samples (i.e., PID measurements). In general, the majority of system operating parameters (i.e., individual well flow rates, system vacuums, etc.) remained consistent and within their respective operating ranges provided in revised Table 3 from the OM&M Manual (ARCADIS 2011b). A detailed description of changes in system

operating parameters is included in each monitoring periods respective quarterly OM&M report (ARCADIS 2012a, ARCADIS 2012b, and ARCADIS 2012c).

4.2.1.2 Vapor Sample

The total effluent screening level vapor sample PID readings measured during 2012 are provided in Table 1. The screening results ranged from 0.0 part per million by volume (ppm_v) to 0.5 ppm_v and were consistent with 2011 and other historical data.

4.2.2 Routine Compliance Monitoring

Similar to the reporting period, system compliance monitoring completed in 2012 consisted of the collection of system compliance vapor samples and the collection of compliance-only induced vacuum readings.

4.2.2.1 System Operating Parameters

Instantaneous vacuum readings measured in compliance monitoring wells during 2012 and the annual time-weighted rolling averages are summarized in Table 2. Instantaneous vacuum readings measured in compliance monitoring wells during 2012 are also shown (in text box format) on Figure 2. The soil gas IRM performance objectives are outlined in Section 2.

Key compliance monitoring results from 2012 include the following:

- As of December 20, 2012, the time-weighted rolling average induced vacuum for all compliance related monitoring points, with the exception of VMWC-18A, was greater than or equal to the design objective of -0.1 iwc. The annual time-weighted rolling average at VMWC-18A was -0.08 iwc. As discussed in Section 4.1.2.1, a condensate removal event has been scheduled for the next reporting period to address this situation. The goal of the planned condensate removal event is to remove accumulated condensate from the subsurface depressurization well pipelines. The system will immediately be rebalanced to return the induced vacuum at all compliance related monitoring points to greater than or equal to -0.1 iwc.

4.2.2.2 Vapor Sample

As shown in the laboratory results in Table 3 and Appendix A, the TVOC concentration of the effluent vapor stream remained relatively constant during 2012 and consistent

with historical data. All emissions were below applicable discharge criteria during all monitoring events as discussed in Section 5 of this report.

- Three environmentally "A" rated compounds (i.e., benzene, carbon tetrachloride, and vinyl chloride), were detected in the effluent vapor during 2012. It should be noted that the mass emission rates for these "A" rated compounds were well below the NYSDEC recommended action level of 0.01 lb/hr. Therefore, no treatment was required (ARCADIS 2011a, ARCADIS 2011b, and ARCADIS 2011c).

- One TIC (acetophenone) was detected during three quarterly sampling events in 2012 and since 2009, has been detected in 60% of the samples collected. Based on these findings, further consideration will be given as to how to proceed with the evaluation of this TIC.

4.2.2.3 Condensate Samples

A non-routine sample was collected for laboratory analysis as a composite grab sample of condensate water generated through normal system operation from the Storage Tank ST-510 location (sample ID ST-510) on March 9, 2012. In addition, a non-routine sample was collected as a composite grab sample (sample ID CON-1) from the 1,230 gallons of condensate water generated during the March 2012 pipeline condensate removal event. As shown in Table 4 and Appendix B, the TVOC concentrations in the two samples were below the discharge criteria set forth in the Nassau County Department of Public Works approval letter (NCDPW 2008) (i.e., 1,000 micrograms per liter [µg/L] of TVOCs).

5. Air Emissions Model

Effluent vapor laboratory results were compared to the NYSDEC DAR-1 SGCs (Table 3). In addition, effluent vapor laboratory analytical results were compared to a site-specific modeled annual maximum allowable stack concentration (MASC). The annual MASC was calculated during each monitoring event for individual compounds using the output from a USEPA SCREEN3 model in conjunction with the NYSDEC DAR-1 AGCs. A scaling factor was calculated using the SCREEN3 model with site-specific physical layout (e.g., building dimension, stack height, terrain, etc.) and operating data (e.g., discharge flow rate, temperature, etc.) inputs for each monitoring event. The scaling factor was then used to adjust (scale) the NYSDEC DAR-1 AGC to a site-specific annual MASC. A summary of the instantaneous percent (e.g., not time-weighted) of the site-specific annual MASC for detected compounds is provided in

Table 5. A summary of the cumulative annual percent (i.e., time-weighted) of the site-specific MASC for detected compounds is also provided on Table 5. A summary of the model input, outputs, and backup calculations is provided in Appendix C.

The soil gas IRM effluent vapor met applicable air discharge criteria based on the following:

- The measured concentrations of individual VOCs in the effluent did not exceed applicable SGCs (Table 3).

- The measured concentration of individual VOCs in the effluent did not exceed applicable instantaneous MASCs, as calculated using the USEPA SCREEN 3 Model (Table 5). Similarly, the time-weighted rolling average for all detected compounds is well below the MASCs.

- Two environmentally "A" rated compounds were detected in the effluent vapor during the reporting period. Specifically, benzene and vinyl chloride were detected at 12 µg/m^3 and 0.95 µg/m^3, respectively. However, the mass emission rates for benzene and vinyl chloride were 2.43 x 10^{-5} and 1.92 x 10^{-6} pounds per hour (lbs/hr), respectively, which are well below the NYSDEC-recommended action level of 0.01 lb/hr. Therefore, no treatment is required.

6. Conclusions and Recommendations

6.1 Conclusions

- The soil gas IRM operated continuously during the reporting period with the exception of brief shutdown periods for routine maintenance, and non-routine alarms and maintenance.

- System operating parameters were generally consistent with the recommended values in the OM&M Manual and system components were operated in accordance with manufacturers' recommendations.

- The soil gas IRM maintained -0.1 iwc within all induced vacuum monitoring points based on a twelve-month rolling average (through December 2012), with the exception of monitoring well VMWC-18A, which had a twelve-month rolling average of -0.08 iwc. As previously discussed, collectively, the data indicates system vacuum was sufficient to prevent soil gas from migrating off-site.

- Vapor emissions met applicable guidance and regulatory criteria.

6.2 Recommendations

Based on the information provided herein, ARCADIS makes the following recommendations for 2013:

- Continue operation of the soil gas IRM.

- Remove accumulated condensate from the subsurface depressurization well pipelines to address the low induced vacuum values at compliance monitoring wells VMWC-7A, VMWC-7B, VMWC-18A, and VMWC-18B.

- Perform an assessment of the TIC acetophenone to determine the appropriate next steps.

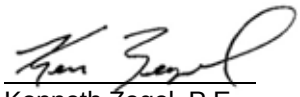
- In accordance with NYSDEC guidance, conduct a review and update, as necessary, the OM&M Manual (ARCADIS 2009), to ensure it continues to effectively address current operating conditions at the site. It is expected that this review will be completed within the 1st quarter of 2013.

- Based on the consistent operation of the soil gas IRM since February 2008, we recommend that the current, quarterly reporting frequency will be reduced to annual. Consistent with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009), an annual report will be prepared to summarize system operation, performance, and monitoring data; this annual report will be prepared and submitted under the supervision of a licensed, professional engineer. Additionally, pertinent data collected for the soil gas IRM will be submitted to the NYSDEC as part of the semi-annual progress reports currently completed in accordance with Section III of AOC Index #W1-0018-04-01. Upon receipt of NYSDEC approval of this recommendation, the OU3 Soil Gas IRM OM&M Manual (ARCADIS 2009) will be updated to reflect this change.

7. Certification

Statement of Certification

On behalf of Northrop Grumman Systems Corporation, I hereby certify and attest that the Operable Unit 3 Soil Gas Interim Remedial Measure is operated in compliance with the remedial action objectives provided within the NYSDEC approved Soil Gas Interim Remedial Measure Work Plan dated February 16, 2007, which was prepared pursuant to NYSDEC Administrative Order on Consent Index # W1-0018-04-01 referencing the Former Grumman Settling Ponds Site and dated July 4, 2005.



Kenneth Zegel, P.E.
Senior Engineer
License # 081598-1

8. References

ARCADIS of New York, Inc. 2007. 95% Design Report, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, September 7, 2007.

ARCADIS of New York, Inc. 2008. 95% Design Report, Appendix C, Sampling and Analysis Plan, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, February 8, 2008.

ARCADIS of New York, Inc. 2009. Operable Unit 3, Operation, Maintenance, and Monitoring Manual, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, January 23, 2009.

ARCADIS of New York, Inc. 2011a. Remedial Investigation Report (Site Area). Operable Unit 3 – Former Grumman Settling Ponds, Bethpage, New York. Site #1-30-003A. February 8, 2011.

ARCADIS of New York, Inc. 2011b. Operable Unit 3- Revised Table 3. Typical Operating Parameters, Operation, Maintenance, and Monitoring Manual, Operable Unit 3, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, February 15, 2011.

ARCADIS of New York, Inc. 2012a. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure March 2012, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, May 18, 2012.

ARCADIS of New York, Inc. 2012b. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure June 2012, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, August 17, 2012.

ARCADIS of New York, Inc. 2012c. Quarterly Operation, Maintenance and Monitoring Report for the Soil Gas Interim Remedial Measure September 2012, Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York, Site #1-30-003A, November 29, 2012.

County of Nassau Department of Public Works, 2007. Letter Regarding Discharge of IRM Condensate Water, Northrop Grumman, OU3 Site, Bethpage, New York. October 16, 2007.

County of Nassau Department of Public Works, 2008. Letter Regarding Discharge of IRM Condensate Water Northrop, Grumman, OU3 Site, Bethpage, New York. September 17, 2008.

County of Nassau Department of Public Works, 2012. Letter Regarding Disposal of Redevelopment Water from Remedial Well RW-1 and Monitoring Wells GM-73D3 and MW3-1, Northrop, Grumman Groundwater Remediation System, Bethpage, New York. January 20, 2012.

New York State Department of Environmental Conservation, 2005, Order on Consent Index #WI-0018-04-01, Site # 1-30-003A, July 4, 2005.

New York State Department of Environmental Conservation, 2007, Approval Letter of 95 Percent Design, Former Grumman Settling Ponds, NYSDEC Nassau County Site No. 1-30-003A OU3 (Bethpage Community Park), September 19, 2007.

New York State Department of Environmental Conservation, 2008. Letter of Approval For Proposed Modifications, December 12, 2008.

New York State Department of Environmental Conservation, 2010. DER-10, Technical Guidance for Site Investigation and Remediation, May 3, 2010.

New York State Department of Environmental Conservation, 2010. Division of Air Resources-1 (DAR-1) Guidelines for the Control of Toxic Ambient Air Contaminants dated 1991 and the AGC/SGC Tables dated October 18, 2010.

United States Environmental Protection Agency (USEPA), 1993, Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Depressurization Systems, October 1993.

Zervos, Theodore, 2007. Deposition of Theodore Zervos in the matter Town of Oyster Bay v. Northrop Grumman Systems Corporation et al. Case No. 05-CV-1945 (TCP)(AKT). January 22, 2007.

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Tables

Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-7S Parameters					Extraction Well DW-7D Parameters					Extraction Well DW-3S Parameters					Extraction Well DW-3D Parameters					Extraction Well DW-5S Parameters					Extraction Well DW-5D Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/09/12	115	-18	47	NM	-2.0	5.0	-7.5	47	NM	-0.44	6.0	-5.0	48	NM	-0.23	9.0	-6.0	47	NM	-0.31	85	-17	48	NM	-1.5	14	-10	47	NM	-2.4
06/04/12	110	-18	62	NM	-1.9	4.0	-6.0**(4)**	61	NM	-0.53	6.0	-5.0	62	NM	-0.27	9.0	-7.0	61	NM	-0.38	80	-15	61	NM	-1.4	14	-10	61	NM	-2.2
09/17/12	100	-23	68	NM	-1.9	2.0	-9.0	69	NM	-0.48	5.0	-4.5	69	NM	-0.25	9.0	-6.0	68	NM	-0.34	80	-16	68	NM	-1.3	9.0	-14	68	NM	-1.8
12/20/12	110	-28	51	NM	-2.1	2.8	-11	52	NM	-0.42	5.2	-5.7	53	NM	-0.27	10	-6.5	51	NM	-0.33	93	-19	51	NM	-1.5	12	-12	51	NM	-2.6

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
iwc	Inches of water column.
NM	Not measured.
ppmv	Parts per million by volume.
scfm	Standard cubic feet per minute.
VMWC	Vapor monitoring well cluster.

1. The system operated with Blower BL-300 online only from May 5, 2009 to May 2, 2012. On May 2, 2012, Blower BL-300 was placed offline and Blower BL-400 was placed online.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Totalizers not recording flow due to fouling. Actual volume of condensate recorded by operations staff between December 5, 2011 to March 9, 2012 was 250-gallons based on measurement from Storage Tank ST-510.
4. Values were remeasured on June 14, 2012 due to erroneous value recorded on June 4, 2012.
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6. Temperature reading not recorded due to operator error.

Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-6S Parameters					Extraction Well DW-6D Parameters					Extraction Well DW-1S Parameters					Extraction Well DW-1D Parameters					Extraction Well DW-4S Parameters					Extraction Well DW-4D Parameters					
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(fpm)	(iwc)	(°F)	(ppmv)	(iwc)
03/09/12	72	-14	48	NM	-1.3	6.0	-5.0	47	NM	-1.5	90	-20	48	NM	-2.0	4.5	-3.0	48	NM	-1.8	85	-16	48	NM	-1.7	7.2	NA	-6.0	48	NM	-0.79
06/04/12	65	-15	61	NM	-1.3	5.6	-5.0	62	NM	-1.8	85	-22	62	NM	-1.3	4.3	-2.8	62	NM	-1.9	80	-16	61	NM	-1.6	7.0	NA	-6.0	62	NM	-0.74
09/17/12	70	-15	(6)	NM	-1.4	4.8	-5.0	68	NM	-1.0	80	-22	67	NM	-1.7	3.7	-2.2	69	NM	-1.1	65	-15	67	NM	-2.0	6.0	NA	-7.5	68	NM	-0.57
12/20/12	76	-17	52	NM	-1.6	5.4	-5.0	51	NM	-1.1	103	-23	52	NM	-2.6	4.2	-2.6	52	NM	-1.1	77	-16	52	NM	-1.4	5.5	NA	-8.8	51	NM	-0.64

Notes and Abbreviations:

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ft bmp	Feet below measuring point.
iwc	Inches of water column.
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scfm	Standard cubic feet per minute.
VMWC	Vapor monitoring well cluster.

1. The system operated with Blower BL-300 online only from May 5, 2009 to May 2, 2012. On May 2, 2012, Blower BL-300 was placed offline and Blower BL-400 was placed online.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
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6. Temperature reading not recorded due to operator error.

Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Extraction Well DW-8S Parameters					Extraction Well DW-9S Parameters					Extraction Well DW-2S Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/09/12	65	-17	48	NM	-2.1	30	-13	48	NM	-1.3	30	-16	48	NM	-1.4
06/04/12	60	-18	62	NM	-1.9	25	-14	62	NM	-1.2	28	-16	62	NM	-1.4
09/17/12	63	-18	67	NM	-1.8	48	-16	67	NM	-1.9	28	-16	66	NM	-1.3
12/20/12	65	-24	53	NM	-2.1	36	-14	53	NM	-1.6	45	-31	52	NM	-2.1

	Extraction Well DW-2D Parameters					Extraction Well DW-10S Parameters					Extraction Well DW-11S Parameters				
Date	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Temperature at Manifold	PID Measured Concentration	Wellhead Vacuum
	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)	(scfm)	(iwc)	(°F)	(ppmv)	(iwc)
03/09/12	36	-22	48	NM	-2.4	30	-13	48	NM	-1.6	44	-20	48	NM	-2.8
06/04/12	34	-21	61	NM	-2.2	30	-13	62	NM	-1.6	40	-19	62	NM	-2.7
09/17/12	34	-19	66	NM	-2.1	38	-17	66	NM	-2.0	31	-19	66	NM	-2.5
12/20/12	49	-33	52	NM	-3.0	20	-32	53	NM	-0.5	20	-25	52	NM	-0.7

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
iwc	Inches of water column.
NM	Not measured.
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VMWC	Vapor monitoring well cluster.

1. The system operated with Blower BL-300 online only from May 5, 2009 to May 2, 2012. On May 2, 2012, Blower BL-300 was placed offline and Blower BL-400 was placed online.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Totalizers not recording flow due to fouling. Actual volume of condensate recorded by operations staff between December 5, 2011 to March 9, 2012 was 250-gallons based on measurement from Storage Tank ST-510.
4. Values were remeasured on June 14, 2012 due to erroneous value recorded on June 4, 2012.
5. Water level measurement not recorded due to operator error.
6. Temperature reading not recorded due to operator error.

Table 1. Annual Summary of General System Operating Parameters, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

	Knock Out Tank Parameters						Blower Parameters[1] BL-200				Blower Parameters[1] BL-300				Blower Parameters[1] BL-400				Combined Blower Parameters VSP-601						Stack Parameters VSP-602		Water Levels in Wells				
	Vacuum			Totalizer																										
Date	Influent KO-200	Influent KO-300	Influent KO-400	Effluent KO-200	Effluent KO-300	Effluent KO-400	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Influent Vacuum	Effluent Pressure	Effluent Flow Rate	Effluent PID	Total Effluent Flow Rate[2]	Total Influent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.	Effluent PID	Discharge Temperature	Effluent Relative Humidity	VMWC-1D	VMWC-5D	B24MW-3	VMWC-1C	VMWC-5B
	(iwc)	(iwc)	(iwc)	(Gallons)	(Gallons)	(Gallons)	(iwc)	(iwc)	(scfm)	(ppmv)	(iwc)	(iwc)	(scfm)	(ppmv)	(iwc)	(iwc)	(scfm)	(ppmv)	(scfm)	(ppmv)	(°F)	(iwc)	(°F)	(ppmv)	(°F)	(%)	(ft bmp)	(ft bmp)	(ft bmp)	(ft bmp)	(ft bmp)
03/09/12	0	-26	0	132.67	10,000,177.33[3]	36.94	NM	NM	NM	NM	-38.0	2.0	NM	NM	NM	NM	NM	NM	626.88	0.2	94	2.5	90	NM	NM	NM	51.75	48.55	52.38	38.12	18.48
06/04/12	0	0	-25[4]	132.67	10,000,177.33	36.94	NM	NM	NM	NM	NM	NM	NM	NM	-32.0	2.0	NM	NM	523.34	0.3	100	3.0	76	NM	NM	NM	NM[5]	NM[5]	NM[5]	NM[5]	NM[5]
09/17/12	0	0	-30	132.67	10,000,177.33	36.94	NM	NM	NM	NM	NM	NM	NM	NM	-34.0	1.0	NM	NM	480.42	0.0	120	2.0	94	NM	NM	NM	53.14	49.15	54.24	38.23	18.48
12/20/12	0	0	-28	132.67	10,000,177.33	36.94	NM	NM	NM	NM	NM	NM	NM	NM	-40.0	1.0	NM	NM	646.67	0.5	101	2.0	80	NM	NM	NM	53.30	48.90	55.05	37.86	18.23

Notes and Abbreviations:

°F	Degrees Fahrenheit.
DW	Depressurization well.
ft bmp	Feet below measuring point.
iwc	Inches of water column.
NM	Not measured.
ppmv	Parts per million by volume.
scfm	Standard cubic feet per minute.
VMWC	Vapor monitoring well cluster.

1. The system operated with Blower BL-300 online only from May 5, 2009 to May 2, 2012. On May 2, 2012, Blower BL-300 was placed offline and Blower BL-400 was placed online.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in standard cubic feet per minute was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Totalizers not recording flow due to fouling. Actual volume of condensate recorded by operations staff between December 5, 2011 to March 9, 2012 was 250-gallons based on measurement from Storage Tank ST-510.
4. Values were remeasured on June 14, 2012 due to erroneous value recorded on June 4, 2012.
5. Water level measurement not recorded due to operator error.
6. Temperature reading not recorded due to operator error.

Table 2. Annual Summary of Induced Vacuum Readings, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York. [1,2]

Well ID:	DW-7S			DW-7D	DW-3S				DW-3D			DW-5S			DW-5D	DW-1S										
Date	VMWC-14A [3]	VMWC-14B [3]	VMWC-14D [3]	VMWC-9A	VMWC-9B	VMWC-10B	VMWC-11B [3]	VMWC-10D	VMWC-11D	VMWC-12D [3]	VMWC-15A [3]	VMWC-15B [3]	VMWC-15D [3]	VMWC-1A	VMWC-2A	VMWC-4A	VMWC-3A [3]	VMWC-1B	VMWC-4B	VMWC-3B [3]	VMWC-1C	VMWC-2C	VMWC-4C	VMWC-3C [3]
03/09/12	-0.10	-0.14	-0.19	NM	NM	NM	-0.13	NM	NM	-0.14	-0.12	-0.11	-0.11	NM	NM	NM	-0.18	NM	NM	-0.18	NM	NM	NM	-0.18
06/04/12	-0.17	-0.19	-0.19[7]	NM	NM	NM	-0.14	NM	NM	-0.18	-0.18	-0.17	-0.18	NM	NM	NM	-0.16	NM	NM	-0.18	NM	NM	NM	-0.18
09/17/12	-0.10	-0.16	-0.15	NM	NM	NM	-0.13	NM	NM	-0.15	-0.13	-0.13	-0.11	NM	NM	NM	-0.13	NM	NM	-0.13	NM	NM	NM	-0.13
12/20/12	-0.12	-0.24	-0.25	NM	NM	NM	-0.13	NM	NM	-0.17	-0.14	-0.14	-0.16	NM	NM	NM	-0.17	NM	NM	-0.17	NM	NM	NM	-0.18
Time Weighted[4] Rolling Average:	-0.12	-0.18	-0.19	NA	NA	NA	-0.13	NA	NA	-0.16	-0.14	-0.14	-0.14	NA	NA	NA	-0.16	NA	NA	-0.16	NA	NA	NA	-0.17

Gross Average Compliance Points[5]

12/20/12	-0.15

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.

1. All induced vacuum measurements units in inches of water column (iwc). Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance related monitoring point.
4. Time weighted average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.
5. Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.
6. Value was measured on March 21, 2012. This value was inadvertently not recorded on March 9, 2012 due to operator error.
7. Values were remeasured on June 14, 2012 due to erroneous values recorded on June 4, 2012.

Table 2. Annual Summary of Induced Vacuum Readings, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York. (1,2)

Well ID:	DW-1D					DW-4D	DW-8S	DW-2S								DW-2D						DW-11S	
Date	VMWC-1D	VMWC-2D	VMWC-4D	VMWC-3D (3)	VMWC-16D (3)	VMWC-16A (3)	VMWC-16B (3)	VMWC-5A	VMWC-6A	VMWC-8A	VMWC-7A (3)	VMWC-5B	VMWC-6B	VMWC-8B	VMWC-7B (3)	VMWC-5D	VMWC-6D	VMWC-8D	VMWC-7D	VMWC-13D (3)	VMWC-17D (3)	VMWC-18A (3)	VMWC-18B (3)
03/09/12	NM	NM	NM	-0.19	-0.19	-0.21	-0.17	NM	NM	NM	-0.10	NM	NM	NM	-0.11	NM	NM	NM	NM	-0.18	-0.28 (6)	-0.15	-0.13
06/04/12	NM	NM	NM	-0.19 (7)	-0.20 (7)	-0.19 (7)	-0.21	NM	NM	NM	-0.12	NM	NM	NM	-0.11	NM	NM	NM	NM	-0.19	-0.23	-0.13	-0.13
09/17/12	NM	NM	NM	-0.14	-0.13	-0.17	-0.14	NM	NM	NM	-0.091	NM	NM	NM	-0.10	NM	NM	NM	NM	-0.15	-0.16	-0.095	-0.10
12/20/12	NM	NM	NM	-0.14	-0.12	-0.20	-0.20	NM	NM	NM	-0.093	NM	NM	NM	-0.096	NM	NM	NM	NM	-0.20	-0.12	-0.026	-0.048
Time Weighted (4) Rolling Average:	NA	NA	NA	-0.16	-0.16	-0.19	-0.18	NA	NA	NA	-0.10	NA	NA	NA	-0.10	NA	NA	NA	NA	-0.18	-0.20	-0.08	-0.10

Notes and Abbreviations:

DW Depressurization well.
NA Not applicable.
NM Not measured.
VMWC Vapor monitoring well cluster.

1. All induced vacuum measurements units in inches of water column (iwc). Values shown have been rounded to include two significant figures.
2. Compliance goal is -0.1 iwc induced vacuum at all compliance monitoring points.
3. Compliance related monitoring point.
4. Time weighted average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.
5. Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.
6. Value was measured on March 21, 2012. This value was inadvertently not recorded on March 9, 2012 due to operator error.
7. Values were remeasured on June 14, 2012 due to erroneous values recorded on June 4, 2012.

Table 3. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York. [1]

Compound[2] (units in µg/m^3)		Sample ID: / Sample Date:	VSP-601 3/9/2012	VSP-601 6/4/2012	VSP-601 9/17/2012	VSP-601 12/20/2012
Project VOCs	CAS No.	SGC				
1,1,1-Trichloroethane	71-55-6	9,000	**7.3**	**8.8**	**14**	**13**
1,1-Dichloroethane	75-34-3	NS	**7.7**	**7.0**	**12**	**13**
1,1-Dichloroethene	75-35-4	380[4]	< 2.8	**1.7**	**2.0**	**2.7**
Benzene	71-43-2	1,300	< 2.8	**3.5**	**28**	**12**
cis-1,2-Dichloroethene	156-59-2	190,000[5]	**460**	**410 D**	**440 D**	**460**
Tetrachloroethene	127-18-4	1,000	**11**	**20**	**26**	**17**
trans-1,2-Dichloroethene	156-60-5	190,000[5]	< 2.8	**3.2**	**5.3**	**4.3**
Trichloroethylene	79-01-6	14,000	**440**	**460 D**	**600 D**	**530**
Vinyl chloride	75-01-4	180,000	< 2.8	< 0.87	< 0.82	**0.95**
Subtotal Project VOCs			**926**	**914**	**1,127**	**1,053**
Non-Project VOCs						
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**270**	**240 D**	**380 D**	**140**
Acetone	67-64-1	180,000	< 28	**11**	< 8.2	< 8.4
Bromodichloromethane	75-27-4	NS	< 2.8	**1.2**	< 0.82	< 0.84
Bromoform	75-25-2	NS	< 2.8	**1.3**	< 0.82	< 0.84
Carbon Tetrachloride	56-23-5	NS	< 2.8	< 0.87	**1.1**	< 0.84
Chlorodibromomethane	124-48-1	NS	< 2.8	**0.95**	< 0.82	< 0.84
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**13**	**8.6**	**6.1**	**5.5**
Chloroform	67-66-3	150	**11**	**13**	**81**	**120**
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	< 2.8	**2.2**	**3.8**	**2.9**
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	< 2.8	**2.3**	**2.3**	**1.6**
Subtotal Non-Project VOCs			**294**	**281**	**474**	**270**
TVOC[3]			**1,220**	**1,195**	**1,601**	**1,323**

Notes and abbreviations on last page.

Table 3. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York. (1)

Notes and Abbreviations:

AGC	Annual guideline concentration.
Bold	Compound detected above method detection limit.
CAS No.	Chemical abstracts service list number.
D	Compound detected at a secondary dilution.
DAR-1	Division of Air Resources-1.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables revised October 18, 2010. An interim SGC was not developed for these compounds because they have low toxicity ratings, as specified in the NYSDEC DAR-1 AGC/SGC tables revised October 18, 2010.
NYSDEC	New York State Department of Environmental Conservation.
SGC	Short-term guideline concentrations specified in the NYSDEC DAR-1 AGC/SGC tables revised October 18, 2010.
TVOC	Total volatile organic compounds.
µg/m^3	Micrograms per cubic meter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Table summarizes detected compounds only.
3. TVOC determined by summing individual detections and rounding to the nearest whole number.
4. An SGC was not provided in the DAR-1 AGC/SGC Tables, dated October 18, 2010. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1- dichloroethene, which is not defined as a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2. or 1,600 µg/m^3 / 4.2 = approximately 380 µg/m^3. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, dated October 18, 2010.
5. An SGC was not provided in the DAR-1 AGC/SGC Tables, dated October 18, 2010. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene and trans-1,2 dichloroethene, which are not defined as a high-toxicity compounds, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 µg/m^3 / 4.2 = approximately 190,000 µg/m^3. An interim SGC was developed for these compounds because they have moderate toxicity ratings, as specified in the DAR-1 AGC/SGC Tables, dated October 18, 2010.

Table 4. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound[2] (units in µg/L)	Sample ID: Sample Date:	CON-1[4] 3/8/2012	ST-510[5] 3/9/2012	ST-510 Qtr 2 2012	ST-510 Qtr 3 2012	ST-510 Qtr 4 2012
Project VOCs	CAS No.					
1,1,1-Trichloroethane	71-55-6	< 5.0	< 5.0	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
1,1-Dichloroethane	75-34-3	< 5.0	< 5.0			
1,1-Dichloroethene	75-35-4	< 5.0	< 5.0			
Benzene	71-43-2	< 5.0	< 5.0			
cis-1,2-Dichloroethene	156-59-2	< 5.0	< 5.0			
Tetrachloroethene	127-18-4	< 5.0	< 5.0			
Toluene	108-88-3	< 5.0	< 5.0			
trans-1,2-Dichloroethene	156-60-5	< 5.0	< 5.0			
Trichloroethylene	79-01-6	< 5.0	< 5.0			
Vinyl chloride	75-01-4	< 5.0	< 5.0			
Xylenes - M,P	1330-20-7	< 5.0	< 5.0			
Subtotal Project VOCs		ND	ND	NA	NA	NA
Non-Project VOCs						
Acetone	67-64-1	< 10	< 10	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
Bromodichloromethane	75-27-4	< 5.0	< 5.0			
Bromoform	75-25-2	< 5.0	< 5.0			
Carbon Tetrachloride	56-23-5	< 5.0	< 5.0			
Chlorodibromomethane	124-48-1	< 5.0	< 5.0			
Chloroform	67-66-3	< 5.0	< 5.0			
Dichlorodifluoromethane (Freon 12)	75-71-8	< 5.0	< 5.0			
Trichlorofluoromethane (Freon 11)	75-69-4	< 5.0	< 5.0			
Subtotal Non-Project VOCs		ND	ND	NA	NA	NA
TVOC[3]		ND	ND	NA	NA	NA

Notes and abbreviations on last page.

Table 4. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[(1)]

Notes and Abbreviations:

CAS No.	Chemical abstracts service list number.
NA	Not applicable.
ND	Not detected.
TVOC	Total volatile organic compounds.
VOC	Volatile organic compound.
µg/L	Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Table summarizes Project VOCs and detected Non-Project VOCs only.
3. TVOC determined by summing individual detections and rounding to the nearest whole number.
4. Sample CON-1 was a non-routine condensate sample collected as a composite grab sample from condensate water that was generated during the March 8, 2012 below grade pipeline condensate removal activities.
5. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

Table 5. Annual Summary of Air Emissions Model Output, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound[1]	AGC[2] ($\mu g/m^3$)	Percent of MASC Per Event[3]				Cumulative % MASC[4]
		3/9/2012	6/4/2012	9/17/2012	12/20/2012	
1,1,1-Trichloroethane	5,000	0.00%	0.00%	0.00%	0.00%	0.00%
1,1-Dichloroethane	0.63	0.03%	0.03%	0.05%	0.06%	0.043%
1,1-Dichloroethene	70	0.00%	0.00%	0.00%	0.00%	0.00%
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	0.00%	0.00%	0.00%	0.00%	0.00%
Acetone	30,000	0.00%	0.00%	0.00%	0.00%	0.00%
Benzene	0.13	0.00%	0.08%	0.56%	0.25%	0.23%
Bromodichloromethane	70	0.00%	0.00%	0.00%	0.00%	0.00%
Bromoform	0.91	0.00%	0.00%	0.00%	0.00%	0.00%
Carbon Tetrachloride	0.067	0.00%	0.00%	0.04%	0.00%	0.011%
Chlorodibromomethane	0.1	0.00%	0.03%	0.00%	0.00%	0.0070%
Chlorodifluoromethane (Freon 22)	50,000	0.00%	0.00%	0.00%	0.00%	0.00%
Chloroform	0.043	0.72%	0.87%	4.90%	7.50%	3.6%
cis-1,2-Dichloroethene	63	0.02%	0.02%	0.02%	0.02%	0.020%
Dichlorodifluoromethane (Freon 12)	12,000	0.00%	0.00%	0.00%	0.00%	0.00%
Tetrachloroethene	1.0	0.03%	0.06%	0.07%	0.05%	0.053%
trans-1,2-Dichloroethene	63	0.00%	0.00%	0.00%	0.00%	0.00%
Trichloroethylene	0.5	2.47%	2.66%	3.12%	2.85%	2.8%
Trichlorofluoromethane (Freon 11)	5,000	0.00%	0.00%	0.00%	0.00%	0.00%
Vinyl chloride	0.11	0.00%	0.00%	0.00%	0.02%	0.0050%

Notes and abbreviations on last page.

Table 5. Annual Summary of Air Emissions Model Output, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

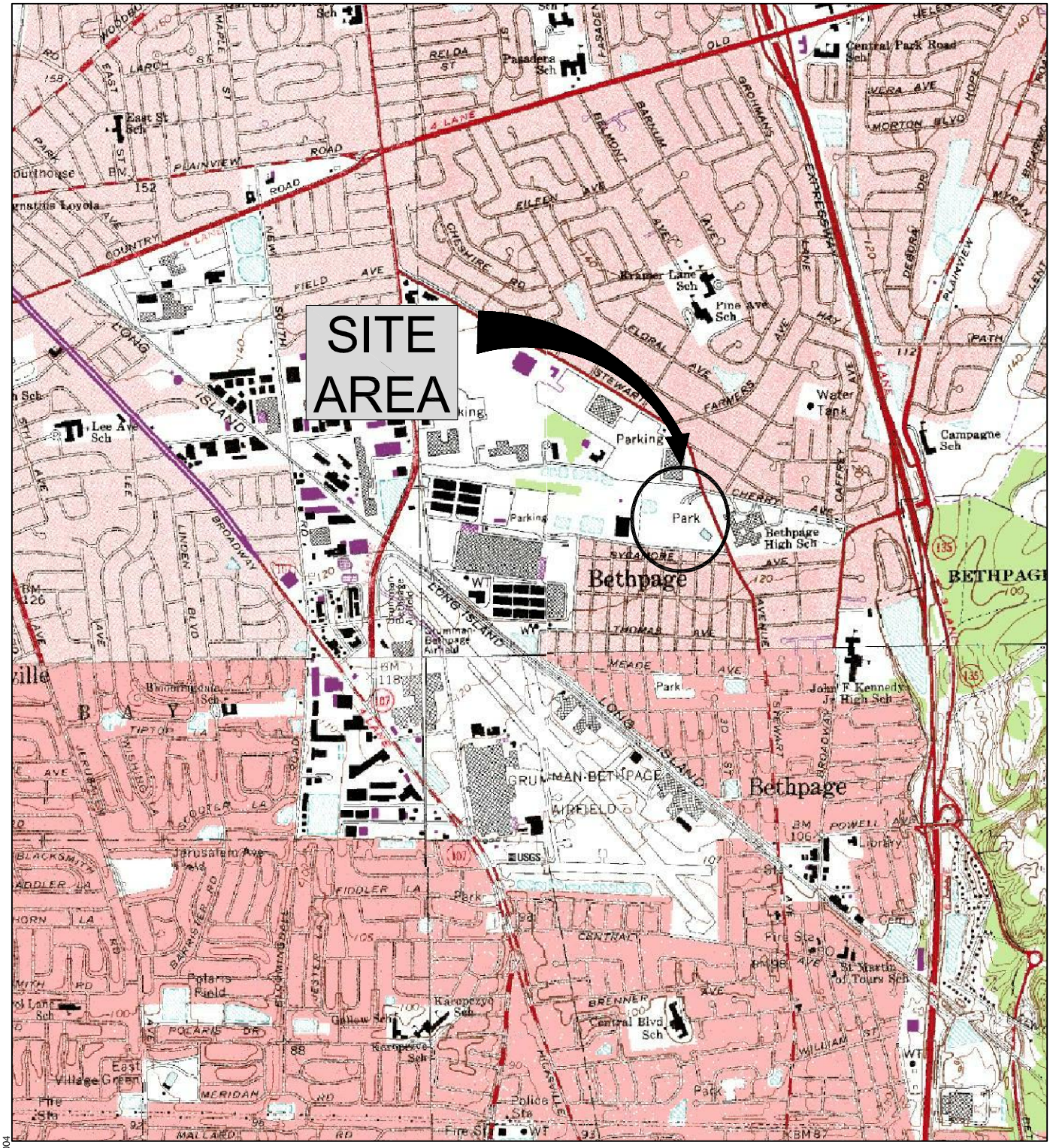
Notes and Abbreviations:

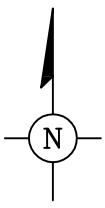
AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
MASC	Maximum allowable stack concentration.
NYSDEC	New York State Department of Environmental Conservation.
SGC	Short-term guideline concentration.
$\mu g/m^3$	Micrograms per cubic meter.

1. Table summarizes detected compounds only.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised October 18, 2010. NYSDEC DAR-1 AGCs were scaled using the results of a site-specific United States Environmental Protection Agency SCREEN 3 model to calculate the annual MASC per monitoring event.
3. Percent of MASC per event was calculated by dividing the actual effluent concentration by the site-specific annual MASC. Detailed calculations are included in Appendix C.
4. Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event. Values shown have been rounded to include two significant figures.

ARCADIS

Figures





0 2000' 4000'

SCALE IN FEET

SOURCE:
USGS 7.5 MIN. AMITYVILLE QUADRANGLE, AMITYVILLE, NY. 1994
USGS 7.5 MIN. FREEPORT QUADRANGLE, FREEPORT, NY., 1994
USGS 7.5 MIN. HICKSVILLE QUADRANGLE, HICKSVILLE, NY., 1967, PHOTOREVISED 1979
USGS 7.5 MIN. HUNTINGTON QUADRANGLE, HUNTINGTON, NY. 1967, PHOTOREVISED 1979

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

SITE AREA LOCATION MAP
SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE
1

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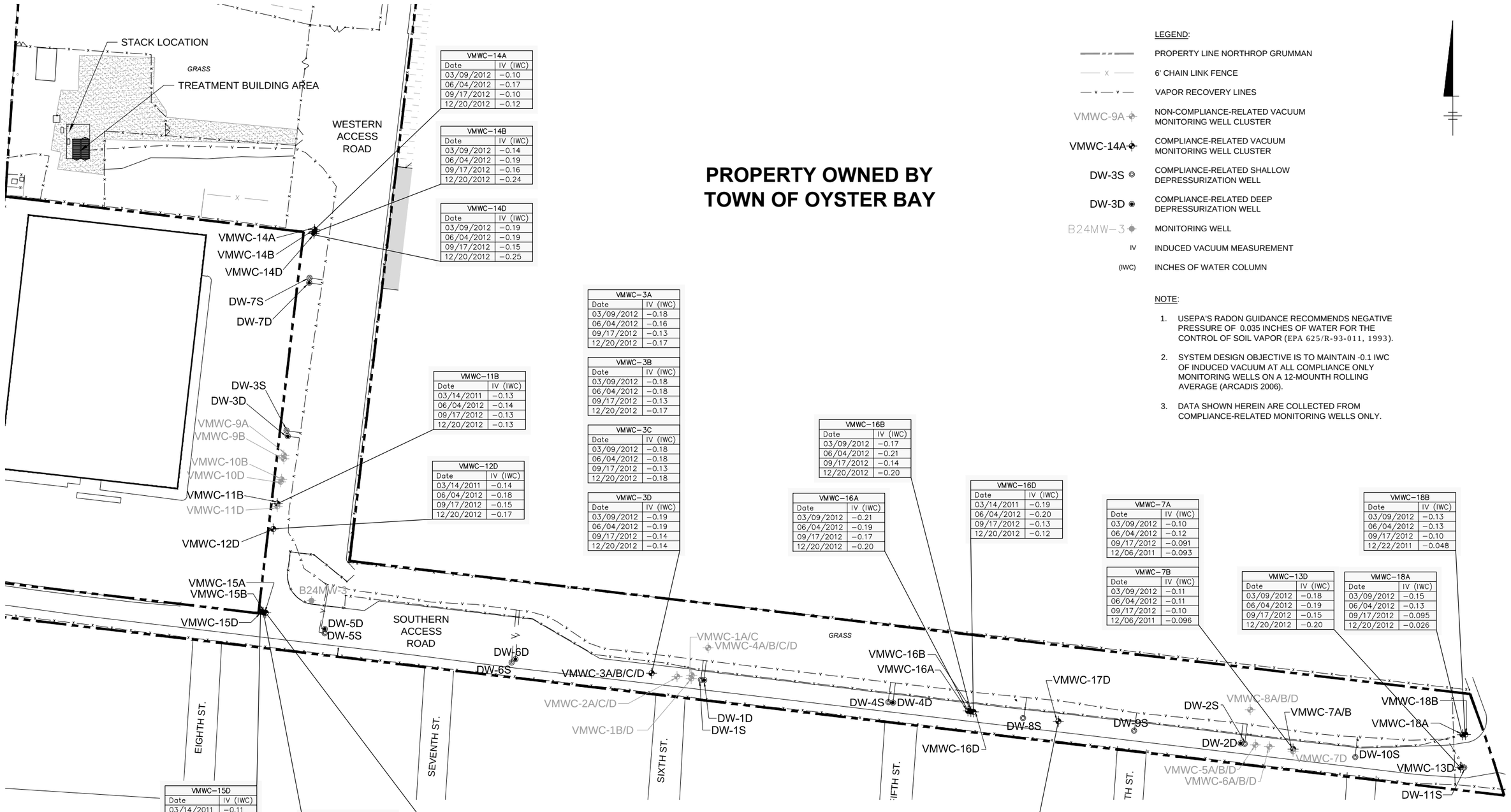

VMWC–14A	
Date	IV (IWC)
03/09/2012	–0.10
06/04/2012	–0.17
09/17/2012	–0.10
12/20/2012	–0.12

VMWC–14B	
Date	IV (IWC)
03/09/2012	–0.14
06/04/2012	–0.19
09/17/2012	–0.16
12/20/2012	–0.24

VMWC–14D	
Date	IV (IWC)
03/09/2012	–0.19
06/04/2012	–0.19
09/17/2012	–0.15
12/20/2012	–0.25

VMWC–11B	
Date	IV (IWC)
03/14/2011	–0.13
06/04/2012	–0.14
09/17/2012	–0.13
12/20/2012	–0.13

VMWC–12D	
Date	IV (IWC)
03/14/2011	–0.14
06/04/2012	–0.18
09/17/2012	–0.15
12/20/2012	–0.17

VMWC–15D	
Date	IV (IWC)
03/14/2011	–0.11
06/04/2012	–0.18
09/17/2012	–0.11
12/20/2012	–0.16

VMWC–15B	
Date	IV (IWC)
03/14/2011	–0.11
06/04/2012	–0.17
09/17/2012	–0.13
12/20/2012	–0.14

VMWC–15A	
Date	IV (IWC)
03/14/2011	–0.12
06/04/2012	–0.18
09/17/2012	–0.13
12/20/2012	–0.14

VMWC–3A	
Date	IV (IWC)
03/09/2012	–0.18
06/04/2012	–0.16
09/17/2012	–0.13
12/20/2012	–0.17

VMWC–3B	
Date	IV (IWC)
03/09/2012	–0.18
06/04/2012	–0.18
09/17/2012	–0.13
12/20/2012	–0.17

VMWC–3C	
Date	IV (IWC)
03/09/2012	–0.18
06/04/2012	–0.18
09/17/2012	–0.13
12/20/2012	–0.18

VMWC–3D	
Date	IV (IWC)
03/09/2012	–0.19
06/04/2012	–0.19
09/17/2012	–0.14
12/20/2012	–0.14

VMWC–16B	
Date	IV (IWC)
03/09/2012	–0.17
06/04/2012	–0.21
09/17/2012	–0.14
12/20/2012	–0.20

VMWC–16A	
Date	IV (IWC)
03/09/2012	–0.21
06/04/2012	–0.19
09/17/2012	–0.17
12/20/2012	–0.20

VMWC–16D	
Date	IV (IWC)
03/14/2011	–0.19
06/04/2012	–0.20
09/17/2012	–0.13
12/20/2012	–0.12

VMWC–17D	
Date	IV (IWC)
03/09/2012	–0.28
06/04/2012	–0.23
09/17/2012	–0.16
12/20/2012	–0.12

VMWC–7A	
Date	IV (IWC)
03/09/2012	–0.10
06/04/2012	–0.12
09/17/2012	–0.091
12/06/2011	–0.093

VMWC–7B	
Date	IV (IWC)
03/09/2012	–0.11
06/04/2012	–0.11
09/17/2012	–0.10
12/06/2011	–0.096

VMWC–13D	
Date	IV (IWC)
03/09/2012	–0.18
06/04/2012	–0.19
09/17/2012	–0.15
12/20/2012	–0.20

VMWC–18B	
Date	IV (IWC)
03/09/2012	–0.13
06/04/2012	–0.13
09/17/2012	–0.10
12/22/2011	–0.048

VMWC–18A	
Date	IV (IWC)
03/09/2012	–0.15
06/04/2012	–0.13
09/17/2012	–0.095
12/20/2012	–0.026

PROPERTY OWNED BY TOWN OF OYSTER BAY

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — COMPLIANCE-RELATED SHALLOW DEPRESSURIZATION WELL
- DW-3D — COMPLIANCE-RELATED DEEP DEPRESSURIZATION WELL
- B24MW–3 — MONITORING WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN

NOTE:

1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE ONLY MONITORING WELLS ON A 12-MOUNTH ROLLING AVERAGE (ARCADIS 2006).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED MONITORING WELLS ONLY.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE
2

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Xref_IRMsystems

DISCHARGE TO ATMOSPHERE

DISCHARGE TO ATMOSPHERE

VSP-602

V-27

TEMPORARY VAPOR PHASE GAC VP-600 (REMOVED FROM OPERATION DECEMBER 2008)

AMBIENT AIR OUTLET

TI 602

TT 602

HEAT EXCHANGER HX-600

ON STANDBY

AMBIENT AIR INLET

PIT 601

PI 601

TI 601

FE

V-26

VSP-601

VSP-201

FE

PI 201

BLOWER BL-200 ON STANDBY

VI 202

VIT 202

VSP-301

FE

PI 301

BLOWER BL-300 ON STANDBY

VI 302

VIT 302

VSP-401

FE

PI 401

BLOWER BL-400

VI 402

VIT 402

WSP-510

SG 510

STORAGE TANK ST-510

VENT

WSP-210

SG 200

AIR FILTER AF-200

KNOCK OUT TANK KO-200

VI 201

RECIRCULATION LINE (TYP. OF 3)

FE 210

FQI 210

TRANSFER PUMP TP-210

WSP-310

SG 300

AIR FILTER AF-300

KNOCK OUT TANK KO-300

VI 301

FE 310

FQI 310

TRANSFER PUMP TP-310

WSP-410

SG 400

AIR FILTER AF-400

KNOCK OUT TANK KO-400

VI 401

FE 410

FQI 410

TRANSFER PUMP TP-410

V-24

V-19

V-21

V-25

V-22

V-20

V-23

V-1

V-2

V-3

V-4

V-5

V-6

V-7

V-8

V-9

V-10

V-11

V-12

V-13

V-14

V-15

V-16

V-17

V-18

VSP-101

VSP-102

VSP-103

VSP-104

VSP-105

VSP-106

VSP-107

VSP-108

VSP-109

VSP-110

VSP-111

VSP-112

VSP-113

VSP-114

VSP-115

VSP-116

VSP-117

VSP-118

FROM DW-7D

FROM DW-3D

FROM DW-5D

FROM DW-6D

FROM DW-1D

FROM DW-4D

FROM DW-2D

FROM DW-11S

FROM DW-10S

FROM DW-2S

FROM DW-9S

FROM DW-8S

FROM DW-4S

FROM DW-1S

FROM DW-6S

FROM DW-5S

FROM DW-3S

FROM DW-7S

DEPRESSURIZATION WELL (TYPICAL OF 7 DEEP)

DEPRESSURIZATION WELL (TYPICAL OF 11 SHALLOW)

LIMIT OF TREATMENT BUILDING 2

LIMIT OF TREATMENT BUILDING 1

LEGEND:

- CONDENSATE LINE
- LIMITS OF TREATMENT BUILDING
- PROCESS VAPOR LINE
- BALL VALVE (NORMALLY OPEN)
- BALL VALVE (NORMALLY CLOSED)
- BUTTERFLY VALVE (NORMALLY OPEN)
- BUTTERFLY VALVE (NORMALLY CLOSED)
- CHECK VALVE
- UNION
- SAMPLE PORT/DRAIN
- REDUCER
- FERNCO
- FLEXIBLE HOSE
- FLANGE
- FE — FLOW ELEMENT ACCESS
- VI 119 — 1/4" BARB INDUCED VACUUM MONITORING CONNECTION
- INLINE INSTRUMENT
- ISOLATED INSTRUMENT CONNECTED TO PROCESS LINE
- INSTRUMENT CONNECTED TO PROCESS LINE

FE	FLOW MONITORING ELEMENT
FI	FLOW RATE INDICATOR
FQI	FLOW TOTALIZER INDICATOR
PI	PRESSURE INDICATOR
PIT	PRESSURE INDICATING TRANSMITTER
SG	SIGHT GLASS
TT	TEMPERATURE TRANSMITTER
VI	VACUUM INDICATOR
VIT	VACUUM INDICATING TRANSMITTER
VSP	VAPOR SAMPLE POINT
WSP	WATER SAMPLE POINT

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

PROCESS FLOW DIAGRAM
SOIL GAS INTERIM REMEDIAL MEASURE

ARCADIS

FIGURE
3

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ARCADIS

Appendix A

Annual Summary of Vapor Sample Analytical Results Including Tentatively Identified Compounds

Appendix A-1. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound (units in µg/m^3)	Sample ID: / Sample Date:	VSP-601 3/9/2012	VSP-601 6/4/2012	VSP-601 9/17/2012	VSP-601 12/20/2012
	CAS No.				
1,1,1-Trichloroethane	71-55-6	**7.3**	**8.8**	**14**	**13**
1,1,2,2-Tetrachloroethane	79-34-5	< 2.8	< 0.87	< 0.82	< 0.84
1,1,2-Trichloroethane	79-00-5	< 2.8	< 0.87	< 0.82	< 0.84
1,1-Dichloroethane	75-34-3	**7.7**	**7.0**	**12**	**13**
1,1-Dichloroethene	75-35-4	< 2.8	**1.7**	**2.0**	**2.7**
1,2-Dichloroethane	107-06-2	< 2.8	< 0.87	< 0.82	< 0.84
1,2-Dichloropropane	78-87-5	< 2.8	< 0.87	< 0.82	< 0.84
1,3-Butadiene	106-99-0	< 2.8	< 0.87	< 0.82	< 0.84
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	**270**	**240 D**	**380 D**	**140**
2-Butanone	78-93-3	< 28	< 8.7	< 8.2	< 8.4
2-Hexanone	591-78-6	< 2.8	< 0.87	< 0.82	< 0.84
4-Methyl-2-Pentanone	108-10-1	< 2.8	< 0.87	< 0.82	< 0.84
Acetone	67-64-1	< 28	**11**	< 8.2	< 8.4
Benzene	71-43-2	< 2.8	**3.5**	**28**	**12**
Bromodichloromethane	75-27-4	< 2.8	**1.2**	< 0.82	< 0.84
Bromoform	75-25-2	< 2.8	**1.3**	< 0.82	< 0.84
Bromomethane	74-83-9	< 2.8	< 0.87	< 0.82	< 0.84
Carbon Disulfide	75-15-0	< 28	< 8.7	< 8.2	< 8.4
Carbon Tetrachloride	56-23-5	< 2.8	< 0.87	**1.1**	< 0.84
Chlorobenzene	108-90-7	< 2.8	< 0.87	< 0.82	< 0.84
Chlorodibromomethane	124-48-1	< 2.8	**0.95**	< 0.82	< 0.84
Chlorodifluoromethane (Freon 22)	75-45-6	**13**	**8.6**	**6.1**	**5.5**
Chloroethane	75-00-3	< 2.8	< 0.87	< 0.82	< 0.84
Chloroform	67-66-3	**11**	**13**	**81**	**120**
Chloromethane	74-87-3	< 2.8	< 0.87	< 0.82	< 0.84
cis-1,2-Dichloroethene	156-59-2	**460**	**410 D**	**440 D**	**460**
cis-1,3-Dichloropropene	10061-01-5	< 2.8	< 0.87	< 0.82	< 0.84
Ethylbenzene	100-41-4	< 2.8	< 0.87	< 0.82	< 0.84
Dichlorodifluoromethane (Freon 12)	75-71-8	< 2.8	**2.2**	**3.8**	**2.9**
Methyl Tert-Butyl Ether	1634-04-4	< 2.8	< 0.87	< 0.82	< 0.84
Methylene Chloride	75-09-2	< 2.8	< 0.87	< 0.82	< 0.84
Styrene	100-42-5	< 2.8	< 0.87	< 0.82	< 0.84
Tetrachloroethene	127-18-4	**11**	**20**	**26**	**17**
Toluene	108-88-3	< 2.8	< 0.87	< 0.82	< 0.84
trans-1,2-Dichloroethene	156-60-5	< 2.8	**3.2**	**5.3**	**4.3**
trans-1,3-Dichloropropene	10061-02-6	< 2.8	< 0.87	< 0.82	< 0.84
Trichloroethylene	79-01-6	**440**	**460 D**	**600 D**	**530**
Trichlorofluoromethane (Freon 11)	75-69-4	< 2.8	**2.3**	**2.3**	**1.6**
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 2.8	< 0.87	< 0.82	< 0.84
Vinyl chloride	75-01-4	< 2.8	< 0.87	< 0.82	**0.95**
Xylene-o	95-47-6	< 2.8	< 0.87	< 0.82	< 0.84
Xylenes - m,p	179601-23-1	< 5.6	< 1.7	< 1.6	< 1.7
TVOC[2]		**1,220**	**1,195**	**1,602**	**1,323**

Notes and abbreviations on last page.

Appendix A-1. Annual Summary of Total Effluent Vapor Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[(1)]

Notes and Abbreviations:

Bold	Compound detected above method detection limit.
µg/m^3	Micrograms per cubic meter.
TVOC	Total volatile organic compounds.
CAS No.	Chemical abstracts service list number.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.

ARCADIS

Appendix A-2. Annual Summary of Total Effluent Vapor Sample Analytical Results, Tentatively Identified Compounds, Northrop Grumman Operable Unit 3, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1,2,3]

Sample ID:	VSP-601	VSP-601	VSP-601	VSP-601
Sample Date:	3/9/2012	6/4/2012	9/17/2012	12/20/2012
Units:	ppbv	ppbv	ppbv	ppbv
1-Decene	No Tentatively Identified Compounds Detected	ND	**0.66 JN**	ND
1-Dodecene		ND	**1.3 JN**	ND
2,3,3-Trimethylpentane		ND	**1.8 JN**	ND
2,3,4-Trimethylpentane		ND	**1.2 JN**	ND
alpha-Cumyl Alcohol		ND	**7.4 JN**	**4.4 JN**
Acetophenone		**3.6 JN**	**5.1 JN**	**12 JN**
Benzaldehyde		**1.3 JN**	**1.3 JN**	**1.1 JN**
alpha-Methylstyrene		**10 JN**	**0.71 JN**	**1.4 JN**
Hexamethylcyclotrisiloxane		ND	**0.75 JN**	ND
Isobutane		ND	**1.7 JN**	ND
Isooctane		ND	**4.8 JN**	ND

Notes and Abbreviations:

Bold Detected.
ppbv Parts per billion by volume.
JN Compound tentatively identified, concentration is estimated.
NA Unidentified compound detected but estimated concentration cannot be calculated.
ND Unidentified compound not detected.

1. Samples were collected by operation and maintenance personnel on the date shown and submitted to Columbia Analytical Services Laboratory (Simi Valley, CA) for volatile organic compound analyses using United States Environmental Protection Agency Method TO-15 modified in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.

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Appendix B

Annual Summary of Condensate Sample Analytical Results Including Tentatively Identified Compounds

Appendix B-1. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound (units in µg/L)	CAS No.	CON-1[3] 3/8/2012	ST-510[4] 3/9/2012	ST-510 Qtr 2 2012	ST-510 Qtr 3 2012	ST-510 Qtr 4 2012
1,1,1-Trichloroethane	71-55-6	< 5.0	< 5.0			
1,1,2,2-Tetrachloroethane	79-34-5	< 5.0	< 5.0			
1,1,2-Trichloroethane	79-00-5	< 5.0	< 5.0			
1,1-Dichloroethane	75-34-3	< 5.0	< 5.0			
1,1-Dichloroethene	75-35-4	< 5.0	< 5.0			
1,2,4-Trichlorobenzene	120-82-1	< 5.0	< 5.0			
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	< 5.0	< 5.0			
1,2-Dibromoethane (EDB)	106-93-4	< 5.0	< 5.0			
1,2-Dichlorobenzene	95-50-1	< 5.0	< 5.0			
1,2-Dichloroethane	107-06-2	< 5.0	< 5.0			
1,2-Dichloropropane	78-87-5	< 5.0	< 5.0			
1,4-Dichlorobenzene	106-46-7	< 5.0	< 5.0			
2-Butanone	78-93-3	< 10	< 10			
2-Hexanone	591-78-6	< 10	< 10			
4-Methyl-2-Pentanone	108-10-1	< 10	< 10			
Acetone	67-64-1	< 10	< 10			
Benzene	71-43-2	< 5.0	< 5.0			
Bromodichloromethane	75-27-4	< 5.0	< 5.0			
Bromoform	75-25-2	< 5.0	< 5.0			
Bromomethane	74-83-9	< 5.0	< 5.0			
Carbon Disulfide	75-15-0	< 10	< 10			
Carbon Tetrachloride	56-23-5	< 5.0	< 5.0			
Trichlorofluoromethane (Freon-11)	75-69-4	< 5.0	< 5.0			
Chlorobenzene	108-90-7	< 5.0	< 5.0	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter
Chlorodibromomethane	124-48-1	< 5.0	< 5.0			
Chloroethane	75-00-3	< 5.0	< 5.0			
Chloroform	67-66-3	< 5.0	< 5.0			
Chloromethane	74-87-3	< 5.0	< 5.0			
cis-1,2-Dichloroethene	156-59-2	< 5.0	< 5.0			
cis-1,3-Dichloropropene	10061-01-5	< 5.0	< 5.0			
Cyclohexane	110-82-7	< 10	< 10			
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 5.0	< 5.0			
Dichlorodifluoromethane (Freon 12)	75-71-8	< 5.0	< 5.0			
Isopropylbenzene	98-82-8	< 5.0	< 5.0			
Ethylbenzene	100-41-4	< 5.0	< 5.0			
Methyl Acetate	79-20-9	< 10	< 10			
Methyl tert-butyl ether	1634-04-4	< 5.0	< 5.0			
Methylcylohexane	108-87-2	< 10	< 10			
Methylene Chloride	75-09-2	< 5.0	< 5.0			
Styrene	100-42-5	< 5.0	< 5.0			
Tetrachloroethene	127-18-4	< 5.0	< 5.0			
Toluene	108-88-3	< 5.0	< 5.0			
trans-1,2-Dichloroethene	156-60-5	< 5.0	< 5.0			
trans-1,3-Dichloropropene	10061-02-6	< 5.0	< 5.0			
Trichloroethylene	79-01-6	< 5.0	< 5.0			
Trichlorotrifluoroethane (Freon 113)	76-13-1	< 5.0	< 5.0			
Vinyl Chloride	75-01-4	< 5.0	< 5.0			
Xylene-o	95-47-6	< 5.0	< 5.0			
Xylenes - m,p	1330-20-7	< 5.0	< 5.0			
TVOC[2]		ND	ND	NA	NA	NA

Notes and abbreviations on last page.

Appendix B-1. Annual Summary of Condensate Sample Analytical Results, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[(1)]

Notes and Abbreviations:

CAS No.	Chemical abstracts service list number.
NA	Not applicable.
ND	Not detected.
TVOC	Total volatile organic compounds.
µg/L	Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. Sample CON-1 was a non-routine condensate sample collected as a composite grab sample from condensate water that was generated during the March 8, 2012 below grade pipeline condensate removal activities.
4. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

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Appendix B-2. Annual Summary of Condensate Sample Analytical Results, Tentatively Identified Compounds, Northrop Grumman Operable Unit 3, Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.[1,2,3]

	Sample ID:	CON-1[4]	ST-510[5]	ST-510	ST-510	ST-510
	Sample Date:	3/8/2012	3/9/2012	Qtr 2 2012	Qtr 3 2012	Qtr 4 2012
	Units:	ug/L	ug/L	ug/L	ug/L	ug/L
1-Decene 1-Dodecene 2,3,3-Trimethylpentane 2,3,4-Trimethylpentane alpha-Cumyl Alcohol Acetophenone alpha-Methylstyrene Hexamethylcyclotrisiloxane Isobutane Isooctane Unidentified Compound Unidentified Siloxane		No Tentatively Identified Compounds Detected	No Tentatively Identified Compounds Detected	No Sampling During This Quarter	No Sampling During This Quarter	No Sampling During This Quarter

Notes and Abbreviations:

µg/L Micrograms per liter.

1. Samples were collected by operation and maintenance personnel on the dates shown and submitted to Columbia Analytical Services Laboratory (Rochester, NY) for volatile organic compound analyses using Method 8260 in accordance with the project Sampling and Analysis Plan (ARCADIS 2008). Data presented in this table corresponds to the past year of system operation.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compounds.
3. All results are estimated.
4. Sample CON-1 was a non-routine condensate sample collected as a composite grab sample from condensate water that was generated during the March 8, 2012 below grade pipeline condensate removal activities.
5. Sample ST-510 was a non-routine condensate sample collected as a composite grab sample from the condensate water generated through normal system operation.

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Appendix C

Annual Summary of Air Modeling Calculations

Table C-1. Annual Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Parameters	Date Sampled:	3/9/2012	6/4/2012	9/17/2012	12/20/2012
SCREEN3 Model Input					
Source Type		Point	Point	Point	Point
Emission Rate (g/s)		1	1	1	1
Stack Height (ft)		33	33	33	33
Stack Height (m)		10.1	10.1	10.1	10.1
Stack Inside Diameter (m)		0.41	0.41	0.41	0.41
Air Flow Rate (scfm)(1)		627	523	494	647
Air Flow Rate (acfm @ stack temp)(2)		655	552	540	684
Stack Gas Exit Temperature (K)(1)		308	311	322	311
Ambient Air Temperature (K)(3)		276	294	293	274
Receptor Height (m)(4)		1.5	1.5	1.5	1.5
Urban/Rural		Urban	Urban	Urban	Urban
Building Height (m)		2.4	2.4	2.4	2.4
Min Horizontal Bldg Dim (m)		4.9	4.9	4.9	4.9
Max Horizontal Bldg Dim (m)		5.0	5.0	5.0	5.0
Consider Bldg Downwash?		Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack		Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base		Simple	Simple	Simple	Simple
Meteorology		Full	Full	Full	Full
Automated Distances Array		Yes	Yes	Yes	Yes
Terrain Height Above Stack Base		0	0	0	0
SCREEN3 Model Output					
1-HR Max Concentration at Receptor Height ($\mu g/m^3$)(5)		1,123	1,388	1,275	1,040
Annualization Factor(6)		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)(7)		89.8	111.0	102.0	83.2
Distance To Max Concentration (m)(8)		48	43	45	50

Notes and abbreviations on last page.

Table C-1. Annual Summary of SCREEN3 Model Input and Outputs, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

acfm	Actual cubic feet per minute.
ft	Feet.
g/s	Grams per second.
K	Kelvin.
m	Meters.
scfm	Standard cubic feet per minute.
$\mu g/m^3$	Micrograms per cubic meter.

1. The stack air flow rate (in scfm) and exit temperature were measured using a handheld thermo-anemometer. Values were measured at the stack effluent location.
2. The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
3. The ambient temperature was recorded from the weather.newday.com website for Islip, New York. The mean actual temperature from the website was used in model calculation.
4. The receptor height corresponds to the average inhalation level.
5. SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
6. A United States Environmental Protection Agency time averaging conversion factor of 0.08 was used to convert the 1-hour maximum concentration output to an annual average.
7. Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization factor.
8. SCREEN3 calculated distance to the 1-hour maximum concentration.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Actual Effluent Concentrations[1] (µg/m^3)			
	3/9/2012	6/4/2012	9/17/2012	12/20/2012
1,1,1-Trichloroethane	7.3	8.8	14	13
1,1-Dichloroethane	7.7	7.0	12	13
1,1-Dichloroethene	0	1.7	2.0	2.7
1-Chloro-1,1-difluoroethane (Freon 142b)	270	240	380	140
Acetone	0	11	0	0
Benzene	0	3.5	28	12
Bromodichloromethane	0	1.2	0	0
Bromoform	0	1.3	0	0
Carbon tetrachloride	0	0	1.1	0
Chlorodibromomethane	0	0.95	0	0
Chlorodifluoromethane (Freon 22)	13	8.6	6.1	5.5
Chloroform	11	13	81	120
cis-1,2-Dichloroethene	460	410	440	460
Dichlorodifluoromethane (Freon 12)	0	2.2	3.8	2.9
Tetrachloroethene	11	20	26	17
trans-1,2-Dichloroethene	0	3.2	5.3	4.3
Trichloroethylene	440	460	600	530
Trichlorofluoromethane (Freon 11)	0	2.3	2.3	1.6
Vinyl chloride	0	0	0	0.95

Notes and abbreviations on last page.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	AGC[2] ($\mu g/m^3$)	Annual MASC[3] ($\mu g/m^3$)			
		3/9/2012	6/4/2012	9/17/2012	12/20/2012
1,1,1-Trichloroethane	5,000	1.80E+08	1.73E+08	1.92E+08	1.86E+08
1,1-Dichloroethane	0.63	2.27E+04	2.18E+04	2.42E+04	2.35E+04
1,1-Dichloroethene	70	2.52E+06	2.42E+06	2.69E+06	2.61E+06
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.80E+09	1.73E+09	1.92E+09	1.86E+09
Acetone	30,000	1.08E+09	1.04E+09	1.15E+09	1.12E+09
Benzene	0.13	4.68E+03	4.50E+03	5.00E+03	4.84E+03
Bromodichloromethane	70	2.52E+06	2.42E+06	2.69E+06	2.61E+06
Bromoform	0.91	3.28E+04	3.15E+04	3.50E+04	3.39E+04
Carbon tetrachloride	0.067	2.41E+03	2.32E+03	2.58E+03	2.49E+03
Chlorodibromomethane	0.1	3.60E+03	3.46E+03	3.85E+03	3.72E+03
Chlorodifluoromethane (Freon 22)	50,000	1.80E+09	1.73E+09	1.92E+09	1.86E+09
Chloroform	0.043	1.55E+03	1.49E+03	1.65E+03	1.60E+03
cis-1,2-Dichloroethene	63	2.27E+06	2.18E+06	2.42E+06	2.35E+06
Dichlorodifluoromethane (Freon 12)	12,000	4.32E+08	4.15E+08	4.62E+08	4.47E+08
Tetrachloroethene	1.0	3.60E+04	3.46E+04	3.85E+04	3.72E+04
trans-1,2-Dichloroethene	63	2.27E+06	2.18E+06	2.42E+06	2.35E+06
Trichloroethylene	0.5	1.80E+04	1.73E+04	1.92E+04	1.86E+04
Trichlorofluoromethane (Freon 11)	5,000	1.80E+08	1.73E+08	1.92E+08	1.86E+08
Vinyl chloride	0.11	3.96E+03	3.80E+03	4.23E+03	4.10E+03

Notes and abbreviations on last page.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Compound	Percent of Annual MASC[4]			
	3/9/2012	6/4/2012	9/17/2012	12/20/2012
1,1,1-Trichloroethane	0.00%	0.00%	0.00%	0.00%
1,1-Dichloroethane	0.03%	0.03%	0.05%	0.06%
1,1-Dichloroethene	0.00%	0.00%	0.00%	0.00%
1-Chloro-1,1-difluoroethane (Freon 142b)	0.00%	0.00%	0.00%	0.00%
Acetone	0.00%	0.00%	0.00%	0.00%
Benzene	0.00%	0.08%	0.56%	0.25%
Bromodichloromethane	0.00%	0.00%	0.00%	0.00%
Bromoform	0.00%	0.00%	0.00%	0.00%
Carbon tetrachloride	0.00%	0.00%	0.04%	0.00%
Chlorodibromomethane	0.00%	0.03%	0.00%	0.00%
Chlorodifluoromethane (Freon 22)	0.00%	0.00%	0.00%	0.00%
Chloroform	0.72%	0.87%	4.90%	7.50%
cis-1,2-Dichloroethene	0.02%	0.02%	0.02%	0.02%
Dichlorodifluoromethane (Freon 12)	0.00%	0.00%	0.00%	0.00%
Tetrachloroethene	0.03%	0.06%	0.07%	0.05%
trans-1,2-Dichloroethene	0.00%	0.00%	0.00%	0.00%
Trichloroethylene	2.47%	2.66%	3.12%	2.85%
Trichlorofluoromethane (Freon 11)	0.00%	0.00%	0.00%	0.00%
Vinyl chloride	0.00%	0.00%	0.00%	0.02%

Notes and abbreviations on last page.

Table C-2. Annual Summary of Maximum Allowable Stack Concentration Calculations, Northrop Grumman Operable Unit 3 Soil Gas Interim Remedial Measure, Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

AGC	Annual guideline concentration.
DAR-1	Division of Air Resources-1.
NYSDEC	New York State Department of Environmental Conservation.
MASC	Maximum allowable stack concentration.
SGC	Short-term guideline concentration.
µg/m^3	Micrograms per cubic meter.

1. Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the past year of system operation. Table summarizes detected compounds only.
2. AGC refers to the compound-specific annual guideline concentration per the NYSDEC DAR-1 AGC/SGC tables, revised October 18, 2010.
3. Annual MASC was calculated by dividing the product of the annual guideline concentration of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.
4. Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for a given monitoring event.